

SECTION 905 -- MASONRY UNITS

905.01 Clay or Shale Brick. Brick shall be in accordance with the following specifications.

(a) **Sewer Brick.** Sewer brick shall be in accordance with AASHTO M 91.

(b) **Manhole Brick.** Manhole brick shall be in accordance with AASHTO M 91.

10 (c) **Building Brick.** Building brick shall be in accordance with AASHTO M 114, Grade SW.

905.02 Concrete Brick. Concrete brick intended for use in construction of manholes, catch basins, and similar structures, or as building bricks, shall be in accordance with ASTM C 55, Grade S-II.

20 **905.03 Concrete Masonry Blocks.** Concrete masonry blocks may be rectangular or segmented and, when specified, shall have ends shaped to provide interlock at vertical joints. Solid masonry units shall be in accordance with ASTM C 139. Hollow load-bearing masonry units shall be in accordance with ASTM C 90, Grade N-II.

SECTION 906 -- JOINT MATERIALS

906.01 Joint Fillers. Joint fillers shall be preformed materials intended to be used in cement concrete pavement and bridge joints or as otherwise specified. Joint fillers shall be in accordance with AASHTO M 153, or AASHTO M 213. However, the asphalt content will be determined by ITM 801, rather than by AASHTO T 42.

906.02 Joint Sealing Materials.

10 (a) **Joint Sealers.** Joint sealers shall consist of materials which are intended to be used in sealing joints and cracks in pavements and structures.

1. Silicone Joint Sealants.

a. Physical Requirements. Silicone joint sealants shall be in accordance with ASTM D 5893.

20 **b. Field Evaluation.** All silicone joint sealants complying with the physical requirements will be subjected to a field evaluation before approval for general use is granted. The Department will maintain a List of the Joint Sealants which comply with the physical requirements and field evaluation.

c. Specific Requirements for Installation of Silicone Joint Sealant. The sealant shall be stored in the original unopened container at or below 32EC (90EF). The sealant shall be placed when the ambient temperature is above 4EC (40EF). The equipment used shall be adequate for the placement of the sealant and shall meet the sealant

manufacturer's recommendations. Air compressors used for the placement of this sealant shall be equipped with traps which remove moisture and oil from the air.

30 The approved sealants which are self leveling shall be identified as such on the Approved List of Joint Sealants and will not require tooling. Sealants not identified as self leveling on the approved list shall be tooled or applied in such a manner which causes them to wet the joint faces. Such sealants which are not formulated for self leveling will not position properly in the joint under its own mass (weight). A backer rod as set out herein shall be used to control sealant configuration and facilitate tooling. Applicable joint configurations shall be as shown on the plans. After a joint has been sealed, all surplus joint sealer on the pavement surfaces shall be promptly removed. Traffic shall not be permitted over sealed joints until the sealer is tack free.

40 **d. Certification.** The manufacturer of the joint sealant shall furnish a type A certification in accordance with 916 for each lot of the joint sealant material furnished to the contract. Each lot of the sealant shall be delivered in containers plainly marked with manufacturer's name or trade mark, lot number, and date of manufacture. The basis of use will be the manufacturer's certification.

2. Hot Poured Joint Sealant.

50 **a. General Requirements.** The sealant shall be in accordance with AASHTO M 301. The material shall be tested in accordance with ASTM D 3407 except that after blotting, the surface of the blocks shall be blown surface dry with compressed air.

b. Packaging and Marking. The sealing compound shall be delivered in the manufacturer's original sealed container. Each container shall be legibly marked with the name of the manufacturer, the trade name of the sealer, the manufacturing batch number or lot, the pouring temperature, and the safe heating temperature.

c. Requirements for Installation. The sealant shall be used in accordance with the manufacturer's recommendations. A backer rod as set out herein shall be used to provide the joint configuration in accordance with the standard drawings.

60 **d. Sampling and Testing.** Samples may be taken prior to delivery provided the plant or warehouse is located in the geographical area serviced by the Department's inspectors. If not sampled prior to delivery, it will be sampled at the job site. Scheduling shall provide two weeks, after delivery to the Division of Materials and Tests for testing. The basis of use will be the applicable laboratory number.

70 **3. Preformed Elastomeric Joint Seals.** This joint seal shall be in accordance with AASHTO M 220. Joint seals furnished under this specification shall be covered by a type A certification in accordance with 916. Sampling of joint seals in accordance with AASHTO M 220 will be required. The lubricant-adhesive shall be covered by a type C certification in accordance with 916.

(b) Backer Rod. The rod is to act as a bond breaker, to control the thickness of the bead, and to provide support for any required tooling of the sealant.

1. Requirements. When hot poured material is used, compatibility of the backer rod with the hot sealant shall be verified before use. The backer rod shall be a closed cell expanded polyethylene foam or an isomeric polymer foam rod. Diameter and placement shall be as shown on the plans.

2. Certification. Backer rod furnished under this specification shall be covered by a type C certification in accordance with 916.

906.03 Joint Mortar. Pipe joint mortar shall consist of one part portland cement and 2 parts sand with water as necessary to obtain the required consistency. Mortar shall be used within 30 minutes after its preparation.

906.04 Rubber Type Gaskets. Ring gaskets for pipe shall be in accordance with AASHTO M 198, type A. Material furnished under this specification shall be covered by a type B certification in accordance with 916.

906.05 Bituminous Mastic Pipe Joint Sealer. This is a cold applied, mineral filled, joint sealing compound for joints of bell and spigot or tongue and groove concrete or clay pipe. It shall be a steam refined petroleum asphalt, plasticized to a homogeneous consistency with mineral fillers.

(a) General Requirements. This sealer shall be a smooth uniform mixture, not thickened or livered, and shall show no separation which cannot be overcome easily by stirring. The material shall be of such consistency and proportions that it can be applied readily with a trowel, putty knife, or caulking gun without pulling or drawing. It shall exhibit good adhesive and cohesive properties when applied to metal, concrete, or vitrified clay surfaces. It shall not be damaged by exposure to below freezing temperatures and shall be applicable when the temperature of the air is between -7EC (20EF) and 38EC (100EF).

(b) Detail Requirements.

1. When applied in a layer 1 mm (1/16 in.) to 3 mm (1/8 in.) thick on a tinned metal panel and cured at room temperature for 24 hours, the bituminous mastic pipe joint sealer shall set to a tough plastic coating free from blisters.

Min. Max.

2. Grease cone penetration unworked, 150 g, 25EC, 5 sec., ASTM D 217, mm/10175 275
3. Non-Volatile, 10 g, 105E C-110EC, 24 hours, % 75
4. Ash, by ignition, % 22 45
5. Flash Point (ASTM D 92), EC (EF)(38) 100
6. Fire Point (ASTM D 92), EC (EF)(66) 150
7. Cold Temperature Flexibility @ -12EC (10EF)Xshall not crack. Test: Trowel joint mastic approximately 6 mm (1/4 in.) thick on heavy kraft paper or very light gage sheet metal. Condition in a freezer at -12EC (10EF) for 3 hours. Bend the sample over a 25 mm (1 in.) diameter pin or mandrel.

8. High Temperature Resistance @ 60EC (140EF), 10 hoursXno sag. Test: Trowel joint mastic approximately 12.5 mm (1/2 in.) thick on a porous concrete slab or piece of concrete block. Place in oven at 60EC (140EF) for 10 hours.

(c) **Certification.** Material furnished under this specification shall be covered by a type C certification in accordance with 916.

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906.06 Bridge Expansion Joints.

(a) **Type SS.** Structural steel shall be in accordance with ASTM A 36M (ASTM A 36), A 588M (A 588), A 570M (A 570), A 242M (A 242), or Merchant Quality 1010, 1020.

Sealant and grouts shall be in accordance with Federal Specifications TT-S-00230 or as recommended by the manufacturer.

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The elastomer shall be neoprene in accordance with ASTM D 3542 except that the physical requirements in Table 1 for low temperature recovery, high temperature recovery, and compression-deflection properties will not apply.

The structural steel and polyurethane sealant shall be covered by a type C certification, and the elastomer shall be covered by a type B certification, both in accordance with 916.

(b) **Type BS2, BS6, BS8, BS9, BS11, and 1-A.** Materials shall be in accordance with ASTM D 3542. The dimension and tolerance requirements shall be as specified in the following table for the type or types of joints specified.

EXPANSION JOINT TYPE	SEAL WIDTH	SEAL HEIGHT	JOINT WIDTH @ INSTALLATION
BS2	41 mm (1 5/8 in.) ▽ 3 mm (▽ 1/8 in.)	41 mm (1 5/8 in.) ▽ 3 mm (▽ 1/8 in.)	22 mm (7/8 in.) + 3 mm, - 6 mm (+ 1/8 in., - 1/4 in.)
BS6	64 mm (2 1/2 in.) - 0, + 6 mm (- 0, + 1/4 in.)	64 mm (2 1/2 in.) + 10 mm, - 3 mm (+ 3/8, - 1/8 in.)	38 mm (1 1/2 in.) + 3 mm, - 6 mm (+ 1/8 in., - 1/4 in.)
BS8	76 mm (3 in.) - 0, + 6 mm (- 0, + 1/4 in.)	83 mm (3 1/4 in.) ▽ 6 mm (▽ 1/4 in.)	48 mm (1 7/8 in.) + 3 mm, - 6 mm (+ 1/8 in., 1/4 in.)
BS9	100 mm (4 in.) - 0, + 6 mm (- 0, + 1/4 in.)	111 mm (4 3/8 in.) ▽ 10 mm (▽ 3/8 in.)	64 mm (2 1/2 in.) + 3 mm, - 6 mm (+ 1/8 in., - 1/4 in.)
BS11	127 mm (5 in.) - 0, + 6 mm (- 0, + 1/4 in.)	128 mm (5 1/8 in.) ▽ 6 mm (▽ 1/4 in.)	75 mm (3 in.) + 3 mm, - 6 mm (+ 1/8 in., - 1/4 in.)
1-A	16 mm (5/8 in.) ▽ 2 mm (▽ 1/16 in.)	17 mm (11/16 in.) ▽ 3 mm (▽ 1/8 in.)	6 mm (1/4 in.) - 0, + 3 mm (- 0, + 1/8 in.)

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The material shall be covered by a type A certification in accordance with 916 and sampling of the material will be required. Satisfactory test results shall be obtained from the samples prior to the installation of the seal. The lubricant-adhesive shall be covered by a type C certification in accordance with 916.

(c) **Type M.** Structural steel shall be in accordance with ASTM A 36M (A 36), A 570M (A 570), A 242M (A 242), A 588M (A 588), or Merchant Quality 1010, 1020.

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Sealant and grouts shall be in accordance with Federal Specification TT-S-00230 or as recommended by the joint manufacturer.

Elastomer shall be neoprene in accordance with ASTM D 3542.

The structural steel and sealant shall be covered by a type C certification and the elastomer by a type B certification, both in accordance with 916.

Bearings above and below the support bar shall be a nylon or urethane compound with polytetrafluorethylene riding surfaces. All components of the system shall be accessible to periodic inspection and component replacement if necessary.

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The elastomeric seals shall be in accordance with the requirements as follows:

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1. Be supplied and installed in one piece
2. Have corner locked edges for a watertight fit
3. Not be any part of the load bearing riding surface
4. Be installed using seal lubricant-adhesive or be mechanically clamped in position to produce a watertight seal
5. Have a shape which promotes self removal of foreign material during normal joint operation
6. Be recessed 13 mm (1/2 in.) below the riding surface throughout the normal limits of joint movement
7. Be held in position by the separator beams
8. Have a hollow box shape for joints utilizing urethane equilibrium control spacers or a strip seal configuration for joints using a mechanical linkage to maintain equidistant separator beam spacing

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The separator beams shall be in accordance with the requirements as follows:

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1. Provide the riding surface across the joint
2. Have an extruded or machined shape suitable to hold the seals
3. Be stable against tipping, tilting, or lifting during application of traffic loads by use of a suitable shape and connection to the support bar
4. Be supported individually on their own independent support bars
5. Maintain equidistant spacing through use of suitable urethane equilibrium type control spacers or through a positive horizontal mechanical linkage or proportioning bar

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The support bars shall be in accordance with the requirements as follows:

1. Incorporate stainless sliding surfaces to minimize resistance to joint movements
2. Be supported above, below, and laterally as required to prevent lifting, to transmit bearing loads, and to maintain positioning of the bar.

220 All support bar boxes and joint housings shall have top, bottom, and sides made of steel plate with 13 mm (1/2 in.) minimum thickness. Anchorages shall consist of looped No. 5 reinforcing bars welded to 13 mm (1/2 in.) steel plates spaced at 230 mm (9 in.) centers. No unwelded steel to steel contact will be permitted.

SECTION 907 -- CONCRETE, CLAY, AND PLASTIC DRAINAGE COMPONENTS

907.01 Non-Reinforced Concrete Pipe. This pipe shall be in accordance with AASHTO M 86M (M 86) for the specified diameter and strength classes. When used for underdrain, each section of pipe shall not exceed 0.9 m (3 ft) in length.

10 **907.02 Reinforced Concrete Pipe.** This pipe shall be in accordance with AASHTO M 170M (M 170) for the specified diameters and strength classes. Unless otherwise specified, pipe wall design and use of elliptical reinforcement in circular pipe are optional.

When the pipe listed below is specified or permitted, it shall be in accordance with the class noted.

Extra Strength Reinforced Concrete Pipe	Class IV
Heavy Duty Reinforced Concrete Pipe	Class V
Reinforced Concrete Pipe	Class III
Reinforced Concrete Sewer Pipe	Class II

20 Precast reinforced concrete end sections shall be in accordance with the cited specifications to the extent to which they apply.

The manufacturer of the steel reinforcement shall furnish to the pipe manufacturer a mill test report. The pipe manufacturer shall certify, on furnished forms that:

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- (a) The pipe has been manufactured in accordance with these Standard Specifications.
 - (b) The area of the steel reinforcement per meter (linear foot) of pipe is in accordance with or exceeds the specification requirements.
 - (c) Based on the steel reinforcement manufacturer's mill test report, the steel used in the pipe is in accordance with the specification requirements.
 - (d) Copies of the steel reinforcement manufacturer's mill test reports shall be on file and available to review for 5 years.

907.03 Reinforced Concrete Horizontal Elliptical Pipe. This pipe shall be in accordance with AASHTO M 207M (M 207). Certification shall be in accordance with 907.02.

40 **907.04 Precast Concrete Manholes, Inlets, and Catch Basins.** These units shall be in accordance with AASHTO M 199M (M 199). References to diameter are applicable to corresponding dimensions in other than circular sections. Absorption tests will not be required for flat top or base slabs. Certification shall be in accordance with 907.02.

No more than three holes shall be cast or drilled in each section for the purpose of handling.

In addition to the requirements of AASHTO M 199M (M 199), the manhole steps shall be permanently marked with the specific step designation, and the manufacturer's identification. This marking shall remain exposed after installation.

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Steps shall be selected from the list of approved manhole steps. Requests for adding steps to the list shall be accompanied by: a certified test report demonstrating compliance with AASHTO M 199M (M 199); instruction for proper installation; complete product description including the ancillary equipment required for installation; and a sample step. The Department may perform a laboratory evaluation of specific steps and may not add steps to the list which are not furnished with ancillary installation equipment.

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907.05 Precast Reinforced Concrete Box Sections. Box sections with 0.6 m (2 ft) of cover or greater shall be in accordance with AASHTO M 259M (M 259) and box sections with less than 0.6 m (2 ft) of cover which are subject to highway loadings shall be in accordance with AASHTO M 273M (M 273). Box sections furnished in accordance with AASHTO M 259M (M 259) or AASHTO M 273M (M 273) shall have a minimum 28 day compressive strength of 34.5 MPa (5,000 psi), as determined by concrete cores. Certification shall be in accordance with 907.02.

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Not more than four holes may be cast, drilled, or otherwise neatly made in the shell of each piece of box section for the purpose of handling or laying. The holes shall be tapered unless drilled, and the tapered holes shall be filled with portland cement mortar or with precast concrete plugs, which shall be secured with portland cement mortar or other approved adhesive, before backfilling. Drilled holes shall be filled with portland cement mortar.

907.06 Blank.

907.07 Blank.

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907.08 Clay Pipe. This pipe shall be in accordance with AASHTO M 65 for the specified diameters and strength classes for circular unperforated pipe. When specified, the bell shall have integral spacer lugs to provide for an annular opening and self centering feature. The pipe may be glazed or unglazed, unless otherwise specified.

907.09 Perforated Clay Pipe. This pipe shall be in accordance with AASHTO M 65 for the specified dimensions and strength classes. It may be glazed or unglazed, unless otherwise specified. Where vitrified clay culvert pipe is furnished, a pipe end section compatible to that as required for concrete or metal pipe shall be used.

907.10 Blank.

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907.11 Drain Tile. This pipe shall be in accordance with AASHTO M 178M (M 178) for concrete or M 179 for clay for the specified material, diameters, and quality classes. Standard quality drain tile shall not be used. When specified, the pipe spigot shall have integral spacer lugs to provide for an annular opening and self centering feature.

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907.15 Blank.

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907.16 Plastic Pipe Manufacturer Requirements. An approved List of Plastic Pipe, Fittings, Solvent Cement, and Elastomeric Seals will be maintained by the Department. The list will specify the manufacturer, plastic pipe, solvent cement, or elastomeric seals designation. All of these materials shall comply with the applicable AASHTO or ASTM requirements and will only be accepted from qualified manufacturers. The manufacturer is defined as the plant which produces the plastic pipe, fittings, solvent cements, or elastomeric seals. The manufacturer shall become qualified by establishing a history of satisfactory quality control of these materials as evidenced by the test results performed by the manufacturer's testing laboratory.

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Manufacturers requesting to be qualified to supply plastic pipe, solvent cements, or elastomeric seals shall submit the following to the Materials and Tests Division.

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(a) A quality control plan which encompasses all aspects of the production process starting with the raw materials and concluding with the shipment of the finished product. The quality control plan shall provide for a 95 percent or greater statistical assurance that the materials will be in accordance with the specifications, and include type and frequency of sampling and testing.

(b) Documentation indicating that the manufacturer's testing laboratory is in accordance with the provisions of AASHTO R 18.

(c) A monthly summary of all test results for the previous 12 months production for each type of plastic pipe, fittings, solvent cements and elastomeric seals.

(d) A material safety data sheet for each material produced.

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(e) To maintain qualification, the manufacturer shall submit to the Materials and Tests Division a monthly summary of all tests for each type of pipe, pipe fittings, solvent cement, and elastomeric seals produced. If a specific type of pipe, pipe fitting, solvent cement, or elastomeric seals is not manufactured in a given month, the monthly submittal shall state: No type ____ pipe, pipe fitting, solvent cement, or elastomeric seals was manufactured during the month of _____ 19____.

The manufacturer shall provide the type of certification specified in the Frequency Manual and in accordance with 916 which designates that hydrostatic design basis, HDB, rated resins or non-HDB rated resins were used in the manufacture of the pipe and fittings.

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907.17 Corrugated Polyethylene Drainage Tubing. Tubing and fittings shall be in accordance with AASHTO M 252. Perforations shall be required for tubing used as a

longitudinal underdrain. Qualification requirements for the manufacturers shall be in accordance with 907.16.

150 **907.18 Perforated Polyvinyl Chloride Semicircular Pipe.** Perforated polyvinyl chloride semicircular pipe may be used as an alternate to 150 mm (6 in.) or less diameter pipe or tile. Pipe shall be in accordance with ASTM D 3034, SDR 35. This semicircular pipe shall have a smooth top and a smooth, semicircular bottom, nominally 118 mm (4 5/8 in.) in diameter, with perforations uniformly distributed along the top of the bottom section in accordance with AASHTO M 252 perforation requirements. The top section shall extend a minimum of 13 mm (1/2 in.) beyond the top of the semicircular section. The top section shall be approximately 162 mm (6 3/8 in.) wide including the sloping overhangs on each side. Qualification requirements for the manufacturers shall be in accordance with 907.16.

907.19 Corrugated Polyethylene Pipe. Pipe and fittings shall be in accordance with AASHTO M 294. The compound used in manufacturing this pipe shall have a minimum cell class in accordance with 335420C as shown in ASTM D 3350. Qualification requirements for the manufacturers shall be in accordance with 907.16.

160 **907.20 Ribbed Polyethylene Pipe.** Pipe and fittings shall be in accordance with ASTM F 894 for the specified sizes. Qualification requirements for the manufacturers shall be in accordance with 907.16.

907.21 Smooth Wall Polyethylene Pipe. Pipe shall be in accordance with ASTM F 714 for nominal diameters of 1000 mm (39 in.) or less. Fittings shall be in accordance with ASTM F 1055. The pipe sizes shall be in accordance with ISO sizing system. The pipe dimension ratio shall be 26 or less. The compound used in manufacturing this type of pipe shall have a minimum cell class in accordance with 335434C as shown in ASTM D 3350. Qualification requirements for the manufacturers shall be in accordance with 907.16.

170 **907.22 Profile Wall Polyvinyl Chloride Pipe.** Pipe and fittings shall be in accordance with AASHTO M 304 for nominal diameters of 900 mm (36 in.) or less. Perforations shall be required when used as a longitudinal underdrain. Qualification requirements for the manufacturers shall be in accordance with 907.16.

180 **907.23 Smooth Wall Polyvinyl Chloride Pipe.** Pipe and fittings shall be in accordance with AASHTO M 278 for pipe sizes 100 mm through 375 mm (4 in. through 15 in.), and ASTM F 679 for pipe sizes 450 mm through 675 mm (18 in. through 27 in.). The compound used in manufacturing pipe shall have a minimum cell class in accordance with 12454C as shown in ASTM D 1784. Qualification requirements for the manufacturers shall be in accordance with 907.16.

907.24 Smooth Wall Pipe for Outlets. Pipe and pipe fittings shall be smooth wall, non-perforated plastic pipe. Qualification requirements for the manufacturers of the following materials shall be in accordance with 907.16.

(a) Type PSM Polyvinyl Chloride Pipe and Fittings. Pipe and fittings shall be in accordance with ASTM D 3034, SDR 23.5.

190 **(b) Schedule 40 Polyvinyl Chloride Pipe.** Pipe shall be in accordance with
ASTM D 1785 and shall have a minimum pipe stiffness of 1030 kPa (150 psi) at 5 percent
deflection when determined in accordance with ASTM D 2412.

907.25 Solvent Cements for Polyvinyl Chloride Pipe and Pipe Fittings. Solvent
cement for polyvinyl chloride pipe and fittings shall be in accordance with ASTM D 2564.
Qualification requirements for the manufacturers of this material shall be in accordance with
907.16.

200 **907.26 Elastomeric Seals.** Elastomeric seals for joining plastic pipe shall be in
accordance with ASTM F 477. Qualification requirements for the manufacturers of this
material shall be in accordance with 907.16.

SECTION 908 -- METAL PIPE

908.01 Blank.

10 **908.02 Corrugated Steel Pipe and Pipe-Arches.** This pipe or pipe-arch and the
coupling bands shall be zinc coated steel or aluminum coated steel in accordance with
AASHTO M 36M (M 36), except as noted herein. They may be fabricated with circumferential
corrugations and riveted lap joint construction or with helical corrugations with continuous
lock or welded seam extending from end to end of each length of pipe. Reforming the ends of
helical corrugated pipe to form circumferential corrugations will be permitted to allow use of
circumferential corrugated coupling bands. The reforming shall be limited to the length
required to accommodate the coupling bands and in such a manner that there is no appreciable
slippage of the seam nor a plane of weakness created.

 The pipe shall be Type I, IA, II, or IIA.

 Band couplers shall have corrugations that mesh with the corrugations of the pipes.

20 Fittings, including stub-tee connections and saddle connectors specified in 715.06, shall
be shop fabricated. Damage to the coating on fittings shall be repaired in accordance with
AASHTO M 36.

 If the pipe or pipe-arch invert is to be paved, it shall first be coated over half its
circumference in accordance with 908.07. The paved invert shall then be constructed in
accordance with 908.07.

 Sheet metal used to fabricate pipe shall be the same brand from the same manufacturer
in any one length of finished pipe.

30 The manufacturer shall furnish to the fabricator a certified mill report for materials
shipped to the fabricator. This certified mill report shall list the kind of base metal, actual test
results of the chemical analysis and mechanical tests of each heat, the thickness, the mass
(weight) of coating, and shall certify that the material complies with specified requirements for
the type of metal furnished.

 The fabricator shall certify, on furnished forms that:

(a) The fabricated structure has been manufactured in accordance with these Standard Specifications

(b) Based on the sheet manufacturer's certified mill report, the materials used in fabricating the structure were tested and the test results are in accordance with the specified requirements

(c) Copies of the sheet manufacturer's certified mill report shall be on file and available to review for five years.

908.03 Blank.

908.04 Corrugated Aluminum Alloy Pipe and Pipe-Arches. Pipes, pipe-arches, and coupling bands shall be in accordance with AASHTO M 196M (M196). The pipe shall be Type I, IA, II, or IIA. If the pipe invert is to be paved, it shall be in accordance with 908.07.

The sheet manufacturer's certified mill report and the fabricator's certification shall be in accordance with 908.02, except the documents shall be in accordance with the applicable requirements of AASHTO M 196M (M196).

Where aluminum alloy pipe culvert is furnished, aluminum alloy end sections shall also be furnished. All component parts shall be aluminum alloy.

908.05 Blank.

908.06 Metal End Sections. The end section's metal shall be in accordance with AASHTO M 36M (M 36) or M 196M (M 196), whichever is applicable. The sheet metal manufacturer's certified mill report and the fabricator's certification shall be in accordance with 908.02 or 908.04, whichever is applicable.

End sections consisting of multiple panels shall have lap seams which shall be tightly jointed with M10 (3/8 in.) galvanized rivets or bolts.

All steel pipe end sections shall have a toe plate anchor constructed of 3.5 mm (0.138 in.) thick galvanized steel. The toe plate anchor shall be match punched to fit holes in the skirt lip, and shall be supplied loose, and complete with M10 (3/8 in.) diameter galvanized bolts.

Straps for pipe end sections shall be either galvanized 20M (No. 6) reinforcing bars or zinc coated 10 mm (3/8 in.) diameter aircraft cable.

908.07 Fiber Bonded Fully Bituminous Coated Corrugated Steel Culvert Pipe and Pipe-Arches. The material, fabrication, the manufacturer's certified mill report, and fabricator's certification shall be in accordance with the applicable requirements of 908.02. The fiber bonding requirements shall be as described herein. Coupling bands shall be fiber bonded fully bituminous coated.

The fibers used in the bonding process shall be aramid. The fibers shall be applied evenly in sheet form on both sides of the steel sheet by embedding them into a molten zinc

bonding medium. Immediately after solidification of the zinc bonding medium, the fibers shall be thoroughly impregnated with an asphalt saturant. The finished steel sheets shall be free from blisters and unsaturated areas. The steel sheets shall then be corrugated and fabricated into culvert. After fabrication, the pipe or pipe-arch shall be fully bituminous coated.

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Connecting or coupling bands shall be of the 2-piece type when used with coated pipe of 900 mm (36 in.) diameter or larger.

The asphalt material for coating shall be in accordance with 902.02. Samples of the asphalt material will be obtained from the working tank prior to or during coating of the pipe, or from strippings off the pipe after coating. When applied to the pipe, the asphalt material shall be free from impurities. The metal shall be free from grease, dust, or moisture. Either process set out below may be used for application.

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- (a) When the pipe is not preheated, the temperature of the asphalt at the time of immersion shall be 204EC ∇ 3EC (400EF ∇ 5EF). The duration of the immersion in the asphalt shall be in accordance with the following:

Thickness (inches)	1.32 mm	1.63 mm	2.01 mm	2.77 mm	3.51 mm	4.27 mm
	(0.052 in.)	(0.064 in.)	(0.079 in.)	(0.109 in.)	(0.138 in.)	(0.168 in.)
Minimum Immersion Time for first Dip (min)	2.0	2.5	3.0	5.0	6.5	8.0

- (b) When the pipe is preheated it shall be brought to a temperature of 149EC (300EF) and the asphalt shall be heated to a temperature of 193EC ∇ 3EC (380EF ∇ 5EF) before the pipe is dipped.

110 In either process, the pipe shall be dipped a second time or more if necessary, to give a minimum thickness of 1.3 mm (0.05 in.).

If paved invert is specified, the pipe or pipe-arch shall first be fully coated as required. Additional bituminous material shall be applied in the bottom section to form a smooth pavement. Except where the upper edges intersect the corrugations, the pavement shall have a minimum thickness of 3 mm (1/8 in.) above the crests of the corrugations. The pavement shall be applied to the lower quarter of the circumference.

120 The manufacturer of the asphalt material shall furnish to the pipe fabricator the type of certification specified in the Frequency Manual and in accordance with 916 for each shipment or lot of asphalt material. The pipe fabricator shall keep these certifications on file and available to review for five years. In addition, samples from the working tank will be obtained for verification of requirements.

908.08 Polymer Precoated Galvanized Corrugated Steel Culvert Pipe and Pipe-Arches. The pipe or pipe-arch and coupling bands shall be in accordance with AASHTO M

245M (M 245) with additions in accordance with 908.02. The polymer precoated galvanized steel sheets shall be in accordance with AASHTO M 246M (M 246), Grade 250/250 (10/10).

908.09 Structural Plate Pipe, Pipe-Arches, and Arches.

(a) **Steel.** Steel structural plate pipe, pipe-arches, and arches shall be constructed from individually galvanized corrugated steel plates as described herein. For pipes and pipe-arches having a thickness less than 7.11 mm (0.280 in.), the bottom plates shall be of the next greater thickness than that specified for the top and side plates, not including corner plates for pipe-arches. The individual plates shall be in accordance with AASHTO M 167M (M 167) and Section 26 of the AASHTO Standard Specifications for Highway Bridges, Division II.

The materials and fabrication shall be as follows:

1. The minimum corner plate radius of the arc joining the top and bottom plates of pipe-arches shall be 457 mm (18 in.) for openings up to and including 12.2 m² (131 sq ft) and 787 mm (31 in.) for openings over 12.2 m² (131 sq ft). The minimum radius of the arc shall be 787 mm (31 in.) for openings from 9.1 m² (98 sq ft) up to and including 19.8 m² (214 sq ft).
2. Assembly bolts shall be in accordance with AASHTO M 164M (M 164), ASTM A 325M (A 325), or ASTM A 449. Nuts shall be in accordance with ASTM A 563M (A 563), class 8S (grade C); AASHTO M 164M (M164); or ASTM A 325M (A 325). Assembly bolts, nuts, and washers shall be galvanized in accordance with ASTM A 153, or be mechanically galvanized and conform to the coating thickness, adherence, and quality requirements of ASTM A 153, class C.
3. The sheet manufacturer's certified mill report and the fabricator's certification shall be furnished in accordance with 908.02, except the documents shall be in accordance with the applicable requirements of AASHTO M 167M (M 167).

(b) **Aluminum Alloy.** Aluminum alloy structural plate pipe, pipe-arches, and arches shall be in accordance with AASHTO M 219M (M 219). The sheet manufacturer's certified mill report and the fabricator's certification shall be furnished in accordance with 908.02.

908.10 Cast Iron Soil Pipe. This pipe shall be in accordance with ASTM A 74. Markings shall be in accordance with ASTM A 74 or ANSI A 40.1.

908.11 Steel Pipe. This item shall be electric-fusion, arc-welded steel pipe in accordance with ASTM A 139, grade B, or electric-resistance welded pipe in accordance with ASTM A 53, Type E, Grade B, as applicable. Material furnished under this specification shall be covered by the type of certification specified in the Frequency Manual and in accordance with 916.

908.12 Straps, Hook Bolts and Nuts Used in Anchors. Straps shall be of the type and size shown on the plans. Reinforcing bars used for straps shall meet the applicable requirements of 910.01 and shall be galvanized in accordance with ASTM A 767M (A 767), class I. Aircraft cable used for straps shall be made of zinc coated steel wire, 9.5 mm (3/8 in.) nominal diameter, consisting of seven 19 wire flexible steel strands, with a minimum breaking strength of 62.3 kN (14,000 lb). The cable shall be in accordance with Military Specification MIL-W-1511.

Hook bolts and nuts shall be of the size shown on the plans, shall be in accordance with the applicable requirements of ASTM A 307, and shall be galvanized in accordance with ASTM A 153. Threads shall be American Standard Coarse Thread Series Class 2 fit. Threads shall be cleaned after galvanizing to provide a free running fit. Maximum oversizing of the nut threads shall be 0.4 mm (1/64 in.).

908.13 Fully Bituminous Coated and Lined Corrugated Steel Pipe and Pipe-Arches. The material, fabrication, bituminous coating, and 100 percent paving shall be in accordance with the applicable requirements of 908.02 and 908.07. Coupling bands shall be fully bituminous coated.

908.14 Slotted Drain or Slotted Vane Drain Pipe. Slotted drains shall be manufactured from helically corrugated steel pipe in accordance with AASHTO M 36M (M 36). At the end of the pipe there shall be two annular corrugations to permit the corrugated band to fully mesh with the pipe.

The grated assembly shall be made of structural steel in accordance with AASHTO M 183M (M 183), Grade 36. The assembly shall be suitably welded to the pipe and galvanized after assembly in accordance with AASHTO M 111. The grate shall be of the size and spacing shown on the plans and shall be welded on both sides to each bearing bar with a 5 mm (3/16 in.) fillet weld.

The size and thickness of the corrugated steel slotted drain pipe shall be as shown on the plans.

Slotted vane drain pipe shall be polyvinyl chloride in accordance with 907.23, and shall be of the diameter specified. The casting shall be in accordance with 910.05(b). The finish shall be standard black asphalt emulsion. Individual units shall have a minimum mass (weight) of 70 kg (155 lbs).

SECTION 909 -- PAINT AND LIQUID EPOXY

909.01 General Requirements. All necessary facilities for inspection of materials and manufacture of paints, enamels, varnish, and ingredients shall be granted. Free access to all parts of the premises where any or all of these products are being prepared shall be allowed. Material Safety Data Sheets shall be provided.

10 Paint shall be furnished ready for use without modification and shall not settle, cake, curdle, liver, gel, or develop excessive change in viscosity between time of manufacture and time of use. It shall remain capable of being readily dispersed with a paddle, or other approved methods, to a consistency appropriate for the intended use. Paint may be sampled and tested at any time prior to use. If, for any reason, re-sampling and retesting following initial or prior approval is indicated, the latest test results shall prevail over all previous tests for material that has not been used. Previously approved paint which is later stored may be re-sampled and retested.

20 Paint shall be delivered in new containers of such strength, durability, design, fabrication, and material that the paint shall be suitably protected in transit and in storage against any change in characteristics which would cause rejection on the basis of laboratory or field evaluation. Each container shall bear a label which shows the name and address of the manufacturer, kind of paint, formula identification date of manufacture, and lot or batch number. The mass per volume (weight per gallon) kg/L (lb per gal.) of the paint shall be accurately determined at 25EC (77EF). The container shall be so filled that the net mass (weight) of the material in the container shall be the product of the mass per volume (weight per gallon) at 25EC (77EF) and the stated number of liters (gallons) in the container.

All labels shall be in accordance with the OSHA requirements for labeling of hazardous chemicals as described in the Hazardous Communications Standard.

30 **909.02 For Metal.** Paints for metal surfaces shall be in accordance with the requirements shown below.

(a) Zinc Primers.

40 **1. Two Component and Multi-Component Inorganic Zinc Silicate Primer.** These paints shall be of the self-cure type which, when mixed and applied in accordance with these specifications, shall cure without the use of a separate curing solution. The multi-component inorganic zinc silicate primers shall have a maximum of three components. The components of each type of paint shall be packaged in such proportions that when the full quantity of each component is mixed together, the specified mixed paint shall be yielded.

These paints shall be in accordance with the following requirements.

- a. Two component solvent based primer shall be in accordance with AASHTO M 300 Type I.

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- b. Multi-component solvent based primer, with low volatile organic compounds for shop painting, shall be in accordance with AASHTO M 300 Type IA.
- c. Two component water based primer shall be in accordance with AASHTO M 300 Type II.

2. Single Package Inorganic Zinc Silicate Primer. The Inorganic Zinc Silicate Primer shall be a single package, self-curing type which, when stirred and applied in accordance with these specifications, cures without the use of a separate curing solution. It shall be in accordance with AASHTO M 300 Type III.

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3. Organic Zinc Primer. Organic zinc primer shall be a single package, self-curing type paint. It shall be in accordance with SSPC paint specification No. 20 type II with exceptions as follows:

Table I, total zinc dust, percent by mass (weight) of pigment requirement shall be a minimum of 87 percent metallic zinc. Table I, total zinc dust, percent by mass (weight) of total solids requirement shall be a minimum of 72 percent metallic zinc.

The organic zinc primer shall also be in accordance with the requirements as follows:

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- a. The viscosity shall be 70 to 100 kreb units.
- b. The mass per volume (weight per gallon) shall be a minimum of 2.04 kg/L (17.0 lb/gal.).
- c. The dry time shall be a maximum of one hour set-to-touch and 24 hours dry hard when applied at 150 :m (6 mil) blade clearance to a tin coated steel panel at 25EC and 60 ∇ 5 percent relative humidity.
- d. The infrared spectrum of the vehicle shall match the infrared spectrum of the vehicle of the sample submitted for formulation approval.
- e. The organic zinc primer shall not exceed 0.419 kg/L (3.50 lb/gal.) volatile organic compounds. The cured film shall not contain toxic heavy metals above the regulatory levels of 40 CFR 261.24.
- f. The organic zinc primer shall be compatible with inorganic zinc and finish coat paints already on the bridge. The color shall be able to produce a distinct contrast with blast cleaned metal surface and the finish coat. The cured organic zinc film shall be compatible with a top coating of vinyl finish or waterborne finish coat paint.

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4. Approval of Formulation. The manufacturer shall obtain approval of the formulation prior to furnishing the primers. To obtain approval, the manufacturer shall submit to the Division of Materials and Tests the following:

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a. A certified test report from an approved independent testing laboratory showing specific test results for all applicable quantitative requirements and resistance test requirements in these specifications. The report shall state the manufacturer's name, brand name of paint including formulation number, date of manufacture, number of the batch tested, beginning and ending dates of resistance tests, and, for the 2-component or multi-component paints, the exact mass (weight) ratio of each component used in the mixed paint tested.

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b. A certification, in accordance with the applicable requirements of 916, indicating compliance with the requirements for the specific primer set out in these specifications.

c. A current material safety data sheet shall be submitted with the initial formulation approval package.

5. Reapproval of Formulation. Reapproval will be required:

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- a. every five years;
- b. each time there is a change in formulation or the manufacturing process;
- c. if three consecutive years elapse without furnishing material;
- d. it may be required when test of material furnished indicate non-conformance with any of the specified requirements.

(b) Vinyl Finish Paint. The vinyl finish coating shall be a one-package, high build vinyl paint for use as a finish coat over a zinc primer. It shall be compatible with and adhere to the cured zinc primer coat.

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1. Vehicle Component. The vehicle shall consist essentially of vinyl chloride-vinyl acetate copolymers. The copolymers may be modified with maleic anhydride and/or acrylic ester resins of high acrylate content. High molecular weight plasticizers of the phthalate or phosphate type shall be included in the vehicle in an amount not to exceed 15 percent, by mass (weight), of the vehicle solids. The solvent system for the vehicle shall be such that all vehicle constituents are mutually soluble.

2. Pigment Component. The pigment shall consist of titanium dioxide (TiO₂) in accordance with ASTM D 476M, type IV, non-reactive, color retentive tinting pigments; and extenders and additives as needed for application properties, provided no impairment of other specified properties results.

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3. Mixed Paint Properties. The mixed paint shall meet the following requirements:

Mass/volume (Weight/gallon) @ 25EC (77EF), kg/L
(lb/gal)..... 1.08-1.20 (9.0-10.0)

	Viscosity @ 25EC (77EF), Krebs Unit.....	80-100
	Total solids, percent by mass (weight), minimum (3 h @ 105EC ∇ 5EC).....	48.0
	Pigment grind, minimum, Hegman.....	5
150	Specular gloss, 60E, 250 :m (10 mil) wet film on a 75 mm (3 in.) by 150 mm (6 in.) tin-coated panel, dried 24 h @ 25EC ∇ 1EC (77EF ∇ 2EF) and 60 percent ∇ 5 percent relative humidity.....	15-25
	Dry time maximum, 75 :m (3 mil) wet film on tin-coated steel panel, @ 25EC ∇ 1E C (77EF, ∇ 2EF) and 45-55 percent relative humidity.....	20 minutes to touch set, 4 h to firm set
	Hiding power, 150 :m (6 mil) wet film on Morest black and white chart paper.....	Complete dry film hiding

160 **4. Color.** The color of the dried paint film shall match the color number of Federal Standard 595a as follows:

Color No.	Color
24227	Green
24466	Light Green
25526	Light Blue
27780	White
13538	Yellow
23717	Buff
27038	Black

5. Storage Life. The paint shall have a usable storage life of at least six months from the date of manufacture, during which period there shall be no hard caking, gelling, gassing (prolonged bubbling). It shall remain capable of easy dispersal by hand stirring. Paint not used within 6 months of the date of manufacture shall be re-sampled.

170 **6. Application.** The paint shall be capable of application by brush, airless, or conventional spray to the equivalent of 75 :m (3 mils) dry film without sags or runs. When applied as uniform wet film, the paint shall dry to a uniform dry film.

(c) Waterborne Finish Paint. The waterborne finish coating shall be a single package, high build acrylic emulsion for use as a finish coat over inorganic and organic zinc primers. It shall be compatible with and adhere to the cured zinc primers.

1. Vehicle Component. The vehicle shall consist of an acrylic emulsion together with the necessary antifoamers, cosolvents, coalescing agent, preservatives, and antifreeze in order to produce a coating in accordance with this specification.

180 **2. Pigment Component.** The active pigment shall consist of titanium dioxide in accordance with ASTM D 476, type IV, and non-reactive color retentive tinting pigments. The pigment shall contain extenders and additives as required for proper application.

3. Mixed Paint Properties. The mixed paint shall be in accordance with the requirements as follows:

	Viscosity @ 25EC, Kneb Units	80-100
	Mass/Volume (Weight) @ 25EC, deviation from approval formulation maximum.....	0.024 kg/L (0.2 lb/gal.)
190	Pigment grind, Hegman, minimum.....	5
	Total Solids, % by mass (weight), 3 h 105EC, minimum	50
	Vehicle Solids, % of vehicle by weight, minimum	40
	Dry time, 75 :m (3 mil) wet film on tin coated steel panel @ 25EC and 50 ∇ 5 % relative humidity, maximum Set-to-touch, h.....	1
	Dry hard, h	24
	Hiding power, 150 :m (6 mil) wet film on mostest black and white chart paper	Complete dry film hiding
200	Specular gloss, 60E, 250 :m (10 mil) wet film on a tin-coated panel, dried 48 h @ 25EC and 50 ∇ 5% relative humidity.....	15-25
	pH 7.0-9.0	
	Maximum volatile organic compounds	0.180 kg/L (1.50 lb/gal.)

 The infrared spectrum of the vehicle when extracted from the mixed paint in accordance with ASTM D 3168 shall match the infrared spectrum of the sample submitted for formulation approval.

210 The color of the paint shall be in accordance with the color requirements of 909.02(b)4.

 The mixed paint shall be in accordance with the requirements of Sections 5.4 through 5.17 of SSPC paint specification No. 24.

 The cured waterborne finish paint shall not contain toxic heavy metals above the regulatory levels of 40 CFR 261.24.

220 **4. Approval of Formulation.** The manufacturer shall obtain approval of the formulation prior to furnishing the waterborne finish paint. The material shall be in accordance with 909.02(a)4 and 909.2(a)5 in order to obtain approval.

909.03 Encapsulation Bridge Paint System. The encapsulation bridge paint system shall consist of a rust penetration sealer, a corrosion inhibited primer, and a topcoat finish paint. The system shall be designed to encapsulate previously applied lead pigmented bridge paints.

The rust penetrating sealer shall be compatible with both the corrosion inhibited primer coating and the topcoat finish paint. It shall be a low viscosity coating for use as a penetrating pre-primer for jointed or bolted areas of steel structures which suffer from pack-rusting.

230 The corrosion inhibited primer shall be compatible with the total encapsulation system. It shall inhibit corrosion of the steel which has been hand tool cleaned in accordance with 619.05(e). The primer shall not cause the previously applied lead based coatings to soften, blister, peel, or delaminate.

The topcoat finish paint shall be a high build, ultraviolet light stable, and weather resistant coating which shall be compatible with all previously applied coatings.

240 An approved List of Encapsulation Bridge Paint Systems will be maintained by the Department. The list will specify the manufacturer's designation of each component of the encapsulation bridge paint system. Manufacturers who desire to have products added to the List of Encapsulation Bridge Paint Systems shall submit the information to the Division of Materials and Tests as follows:

250 (a) Documented information detailing the past history and experience with the encapsulation system in terms of service life under the specific conditions of use. It shall be shown that less than one percent of rust has recurred after a minimum of three years of service on a previously primed encapsulated lead pigmented coated bridge. The documentation shall consist of an inspection report from an independent National Association of Corrosion Engineers certified coating inspector, or an inspection report from another state's transportation agency or from the FHWA.

(b) All details relative to surface preparation and application of the encapsulation system.

260 (c) Identifiable characteristics to permit laboratory test verification of each coating's identity. Such characteristics shall include formulation information which shall be verifiable in a laboratory. Such information shall consist of the general nature of the vehicle, pigments, and volatile portions, the weight per gallon (mass per liter), percent solids by weight and volume, and an infrared spectrum of the vehicle portion of each coating.

(d) An outline of the procedures used for quality control during the manufacture of each coating.

(e) A current Material Safety Data Sheet for each coating.

270 Upon acceptance of the above information, the Department may require a minimum of a one year field evaluation of the product.

909.04 For Wood or Metal.

(a) **Primer for Field Paint.** For unpainted galvanized metal, use one coat of zinc dust-zinc oxide type primer. The primer shall be in accordance with Federal Specifications TT-P-641, type II.

(b) **White Field Paint, Finish Coat.** This paint shall be in accordance with the following requirements:

280		Min.	Max.
	Pigment, % by mass (weight).....	29.0	33.0
	Titanium Dioxide (Type IV), % by mass (weight).....	91.0	---
	Zinc Oxide, % by mass (weight)	4.0	---
	Pigment Suspending Agent, % by mass (weight).....	---	20
	Vehicle, % by mass (weight).....	67.0	71.0
	Solids, (TT-R-266, Type 1, Class B), % by mass (weight).....	54.0	---
	Mass/volume (Weight), kg/L (lb/gal.) @ 25EC	1.2	---
	Viscosity (Krebs Units) @ 25EC (77EF).....	75	85
	Dry time, 75 :m (3 mil) wet film on tin-coated steel panel,	Touch	6
290	@ 25EC ∇ 1E C (77E F ∇ 2EF) and 45-55% relative		
	humidity, hours	Hard	18
	Specular gloss, 60E, 24 h air dry.....	75	---
	Pigment grind, Hegman.....	6	---

Must not sag, streak, or run when applied to a smooth, vertical surface.

909.05 White and Yellow Traffic Paint.

(a) Standard Traffic Paint.

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1. General Requirements. White and yellow traffic paint shall be used on pavements for centerlines, lane lines, or as otherwise specified. In addition to its other requirements, when glass beads are applied, it shall be such that it shows capillary action in the interstices and voids existing between the beads sufficient to cause the level of the paint to be raised approximately 2/3 the diameter of the beads to provide anchorage and refraction. The capillary action shall be such that it does not cause complete envelopment. The paint, as furnished, shall contain no glass beads.

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The paint shall be ground to a uniform consistency and shall permit satisfactory application by the pressure spray type of painting machine currently in use by the Department. This painting equipment is designed to apply reflectorized lines, using the drop-on bead method, 100 mm (4 in.) to 150 mm (6 in.) wide, at a wet film thickness of 0.381 mm (0.015 in.) on clean, dry pavements at ambient temperatures of 4EC (40EF) or higher at speeds of 16.09 to 24.14 km/h (10 to 15 mph). The material shall have physical characteristics which permit it to be pumped through gear type pumps from the shipping container into the paint tanks, and by compressed air from the paint tanks through the paint machine plumbing system at a minimum ambient temperatures of 4EC (40EF).

320

The paint shall be furnished ready for use without thinning or other modification and shall not settle, cake, curdle, liver, gel, or show excessive change in viscosity in the container

during a period of one year after manufacture and shall be capable of being broken up with a paddle to a smooth consistency. The manufacturer shall furnish any necessary information as to special storage requirements. The paint may be rejected if it contains skins, thickened or jelly-like layers or lumps, coarse particles, dirt, or other foreign material. The composition of the pigments and vehicles of the paints are at the option of the manufacturer, provided the paints conform with the requirements specified herein.

The paint shall be supplied in new removable head 210 L (55 gal.) drums which conform to DOT Specification 17-H, or in new 19 L (5 gal.) removable lid buckets conforming to the appropriate DOT Specifications. The drums shall be filled with 190 L (50 gal.) of paint. Volume measurements shall be based on a liquid temperature of 25EC (77EF). Drums shall be provided with reusable multiseal sponge gaskets, of a type which prevents the paint from skinning during storage, and shall be equipped with outside locking rings or clamps. Each drum shall show true mass (weight), gross mass (weight), net mass (weight), equivalent net volume (gal.), name and address of manufacturer, batch number, kind of paint, color, and date of manufacture.

2. Specific Requirements.

		Min.	Max.
340	Pigment, Federal Standard 141A, Method 4022, percent by mass (weight).....	54	60
	Titanium Dioxide, ASTM D 476, Types II, III, or IV, white only, g/L (lb/gal.) of paint	96 (0.8)	---
	Medium Chrome Yellow, ASTM D 211, Type III, yellow only, g/L (lb/gal.) of paint.....	144 (1.2)	---
	Other pigments may be used provided the amount of pigment is such that there will be a minimum of 0.125 kg of pure lead chromate per liter (1.04 lb/gal.) of paint.		
350	Vehicle Solids, percent of vehicle by mass (weight), Federal Standard 141A, Method 4053	40	---
	Total Non-Volatiles, Federal Standard 141A, Method 4042, percent by mass (weight).....	74	---
	Viscosity @ 25EC (77EF), ASTM D 562, Krebs Units	70	80
	Luminous Directional Reflectivity, ASTM E 308 or E 97, percent		
	White	84	---
	Yellow	50	---
360	Color, yellow only, x-y C.I.E. coordinates for green limit, FHWA color chart of June 1965.....	Match the green limit ∇ 8%	
	Dry time to no pick-up ASTM D 711, wet film 380 ∇ 25:m (15 mils ∇ 1 mil), with bead cover approx. 719 g/L (6 lb/gal.), minutes	10	30
	Contrast ratio, ASTM D 2805, wet film 380 ∇ 25:m (15 ∇ 1 mil), black - white chart paper, air dried at least 16 hours.....	0.96	---
	Flexibility, Federal Specifications TT-P-85D	No breaking or cracking	

(b) Fast Dry Traffic Paint.

1. General Requirements. The general requirements specified for standard traffic paint in 909.05(a)1 shall apply except as modified herein.

The paint shall be ground to a uniform consistency, and it shall permit satisfactory application by the pressure spray type of painting machine currently in use by the Department. This painting equipment is designed to apply reflectorized lines, using a pressurized bead application method, 100 mm to 150 mm (4 to 6 in.) wide, at a wet film thickness of 380 :m (0.015 in.) on clean dry pavement, with the material being heated at a maintained temperature from ambient air temperature to a maximum of 82EC (180EF), at the atomized spray gun, at a minimum ambient temperature of 4EC (40EF). The material shall be capable of being applied under these conditions at speeds of 16 to 24 km/h (10 to 15 mph). The material shall have physical characteristics which permit it to be pumped at a minimum temperature of 4EC (40EF) through pumps from the shipping container into the paint tank on the paint machine, and then by pumps through the paint machine plumbing system to and through the heat exchanger and to the spray gun at the proper pressure and temperature.

2. Specific Requirements. The paint shall dry to a no tracking condition in no more than 60 seconds. The no tracking condition shall be determined by actual application on the pavement at a wet film thickness of 380 :m (15 mils) with white or yellow paint covered with glass beads at a rate of 0.7 kg/L (6 lb/gal.). The paint lines for this test shall be applied with the specialized striping equipment operated so as to have the paint at temperatures up to 82EC (180EF) at the spray orifice. This maximum no tracking time shall not be exceeded when the pavement temperature varies from 2EC (35EF) to 49EC (120EF), and under all humidity conditions providing that the pavement is dry. The no tracking time shall be determined by passing over the paint line 60 seconds after paint application, in a simulated passing maneuver at a constant speed of 48 to 64 km/h (30 to 40 mph) with a passenger car. A line showing no visual deposition of the paint to the pavement surface when viewed from a distance of approximately 15 m (50 ft) from the point where the test vehicle has crossed the line shall be considered as showing no tracking and conforming to the requirement for field drying conditions. This field dry time test shall be used for production samples only.

In addition to the above, the paint shall meet the following requirements:

	Min.	Max.
Pigment, Federal Standard 141A, Method 4022, percent by mass (weight).....	54	60
Titanium Dioxide, ASTM D 476, Types II, III, or IV, white only, g/L (lb/gal.) of paint.....	96 (0.8)	---
Medium Chrome Yellow, ASTM D 211, Type III, yellow only, g/L (lb/gal.) of paint	144 (1.2)	---
Other Pigments may be used, provided the amount of pigment is such that there will be a minimum of 0.125 kg/L (1.04 lbs/gal.) of pure lead chromate per gallon of paint.		

	Vehicle Solids, percent of vehicle by mass (weight), Federal Standard 141A, Method 4053.....	35	---
420	Total Non-Volatiles, Federal Standard 141A, Method 4042, percent by mass (weight)	72	---
	Viscosity @ 25EC (77EF), ASTM D 562, Krebs Units	80	100
	Luminous Directional Reflectivity, ASTM E 308 or E 97, percent		
	White.....	84	---
	Yellow.....	50	---
	Color, yellow only, x-y C.I.E. coordinates for green limit, FHWA color chart of June 1965	Match the green limit ∇ 8%	
430	Contrast ratio, ASTM D 2805, wet film 380 ∇ 25 :m (15 ∇ 1 mil) black - white chart paper, air dried at least 16 hours	0.96	---
	Uncombined (free) Water, Federal Standard 141A, Method 4081, percent	---	1.0

(c) White and Yellow Waterborne Traffic Paint. White and yellow waterborne traffic paints shall consist of an emulsion of pigmented binder.

440 When glass beads are induced into the paint lines, the paint shall provide capillary action in the interstices and voids between the glass beads sufficient to cause the level of paint to raise approximately two thirds the diameter of the glass beads. This capillary action shall not cause complete envelopment of the glass beads. The paint as furnished shall not contain glass beads. The paint shall be ground to a uniform consistency, and it shall permit satisfactory application by the pressure-spray type of painting equipment. The painting equipment shall use a pressurized bead application method that is designed to apply 100 to 150 mm (4 to 6 in.) reflectorized paint lines at paint temperature up to 65EC (150EF). The paint shall be capable of being applied at speeds of 15 to 25 km/h (10 to 15 mph).

450 The paint shall not darken under the heating conditions of application, or show appreciable discoloration due to sunlight exposure and aging of the paint lines. The paint shall be furnished ready for use without thinning, screening, or other modifications and shall not settle, cake, curdle, liver, gel, or have an excessive change in viscosity in the container during a period of one year after manufacture. The paint shall be capable of being stirred to a uniform consistency. The paint shall be able to withstand variations of temperatures when stored outside in the containers as delivered, and in an environment above 5EC (40EF). All paint furnished under these specifications will be rejected if it contains skins, thickened or jelly-like layers, lumps, coarse particles, dirt, or other foreign materials which prevent the proper application of the paint, or produces a non-uniform paint line. All paint which cannot be transferred by pumps on the paint equipment from the shipping containers and through the paint equipment due to excessive clogging of screens, filters, or paint guns will be rejected.

The paint shall dry to a no-tracking condition in less than 60 s. The no-tracking condition shall be determined by actual application of the paint on the pavement at a wet

film thickness of 380 Φ m (15 mils) with glass beads applied at a rate of 0.7 kg/L (6 lb/gal.). The paint lines for the determination of no-tracking condition shall be applied with the specialized painting equipment operated so as to have the paint at application temperatures up to 60EC (140EF) at the spray guns. The maximum no-tracking time shall not be exceeded when the pavement temperature varies from 10EC to 50EC (50EF to 120EF), and with all relative humidity conditions providing that the pavement is dry. The no-tracking time shall be determined by passing over the paint line 60 s after the paint application, in a simulated passing maneuver at a constant speed of 50 to 65 km/h (30 to 40 mph) with a passenger car. A paint line with no visual deposition of the paint to the pavement surface when viewed from a distance of approximately 15 m (50 ft) from the point where the vehicle crossed the paint line shall be considered as showing a condition of no-tracking and being in accordance with the requirement.

1. Composition Requirements. The exact composition of the waterborne traffic paint shall be left to the discretion of the manufacturer, provided that the finished product is in accordance with all of the specification requirements.

The pigment portion of these paints shall be a combination of prime and extender pigments as required to produce either white or yellow waterborne traffic paint in accordance with the color and other requirements of the finished product. The yellow waterborne traffic paint pigment shall contain pigment yellow Colour Index Number 65 and/or 74 and/or 75. The white waterborne traffic paint pigment shall contain titanium dioxide in accordance with ASTM D 476. The non-volatile portion of the vehicle shall be composed of a 100% acrylic polymer.

The cured film of waterborne traffic paint shall not contain toxic heavy metals above the limits of the regulatory levels of 40 CFR 261.24 Table 1 when tested in accordance with EPA Toxicity Characteristics Leaching Procedure Test Method 1311 in Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, EPA publication SW-846. It shall not contain other hazardous materials which would require characterization as a hazardous waste for the disposal of the dried film.

2. Specific Requirements.

	Minimum	Maximum
Volume solids, ASTM D 2697, %	58.0	--
Total solids by mass, ASTM D 3723, %	73.0	--
Pigment by mass, ASTM D 3723, %	45.0	57.0
Vehicle solids by mass of the vehicle, %	44.0	--
Viscosity, ASTM D 562, Kreb Units	75	95
Unit mass @ 25EC (77EF) ASTM D 1475, kg/L (lb/gal.)	1.498 (12.50)	--

	Unit mass @ 25EC (77EF), variation between manufacturer's production batches, ASTM D 1475, g/L (lb/gal.)	--	24 (0.20)
520	Dry time, ASTM D 711, 380 Φ m (15 mils) wet film thickness, at 25EC (77EF), 50% ∇ 5% relative humidity, airflow of less than 1.4 m ³ /min (50 ft ³ /min), without glass beads,	--	10 minutes
	Luminous directional reflectivity ASTM E 97, ASTM E 308, 380 Φ m (15 mils) wet film thickness, air dried a minimum of 16 h, %		
530	White	84	--
	Yellow	50	57
	Color, yellow only, x & y C.I.E. Coordinates for the strong limits of FHWA color chart PR1, 380 Φ m (15 mils) wet film thickness, air dried a minimum of 16 h, measured on white background, % deviation	Match the strong limits	∇ 6.00
540	Coarse material retained on a 600 Φ m (No. 30) sieve, ASTM D 185, %	--	0.05
	Bleeding ratio, Federal Specifications TT-P-1952B, except asphalt saturated felt paper shall be in accordance with ASTM D 226 Type I	0.97	--
550	Contrast ratio, ASTM D 2805, 254 Φ m (10 mils) wet film thickness on Leneta Form 2A or 2C, air dried a minimum of 16 h	0.96	--
	Volatile organic compounds, ASTM D 3960, g/L (lb/gal.)	--	150 (1.25)
	Abrasion resistance, Federal Specifications TT-P 1952B, L	190	--
560	Freeze-thaw stability, Federal Specification TT-P 1952B, change in consistency, Kreb Units	--	10

	Heat stability, Federal Specifications TT-P 1952B, change in consistency, Krebs Units	--	10
	Scrub resistance, ASTM D 2486, with abrasive medium and shims, cycles	300	--
570	Water resistance, Federal Specification TT-P 1952B	Film shall not soften, blister, wrinkle, or lose adhesion.	
	Flexibility, Federal Specifications TT-P-1952 B	No cracking or flaking of film.	
580	Infrared spectrum of the vehicle, ASTM D 3168	Shall match spectrum of manufacturer's previously submitted samples.	

Dilution test shall be capable of dilution with water at all levels without curdling or precipitation such that wet paint can be cleaned up with water only.

3. Formulation Approval. The manufacturer shall obtain approval of the waterborne traffic paint formulations prior to furnishing the paints. To obtain approval, the manufacturer shall submit the following to the Materials and Tests Division:

590 a. A certified test report from an independent testing laboratory showing specific test results for all quantitative requirements and resistance test requirements in these specifications. The report shall state the manufacturer's name, brand name of paint, formulation identification, day, month and year of manufacture, number of batch tested, and the beginning and ending dates of each test.

b. A type A certification in accordance with 916 from the paint manufacturer's laboratory.

600 c. A quality control plan which encompasses all aspects of the production process starting with the raw materials and concluding with the shipment of the finished product. The quality control plan shall provide for a 95% or greater statistical assurance that the paint will be in accordance with the specifications, and include specific type and frequency of sampling and testing.

d. Documentation indicating that the manufacturer's quality control laboratory is in accordance with AASHTO R 18.

e. Documented information detailing the past history and experience with the specific formulation in terms of service life and the specific conditions of use. The

documented information shall include specific details about durability and reflectivity of the paint.

f. The specific paint formulation by mass and volume of each of the raw materials contained in the finished paint.

g. Material safety data sheets for the finished paint and for each raw material contained in the finished paint.

h. An infrared spectrum of the paint's vehicle extracted from the finished paint in accordance with ASTM D 3168.

4. Formulation Reapproval. The waterborne paint formulation reapproval will be required as follows:

a. Each time there is a change in the formulation or manufacturing process.

b. When testing of the waterborne paint indicates continual non-compliance with these specifications.

c. When field evaluations indicate that the paint does not provide the required performance.

909.06 Blank.

909.07 Miscellaneous Paints and Ingredients.

(a) Stencil Paint. This paint is to be used for painting signs. It shall conform to type I paint or type II paste of Federal Specification TT-P-98. The color shall be stated.

(b) Zinc Chromate Paint. Zinc chromate paint shall be in accordance with Federal Specification TT-P-645. For quantities greater than 4 L (1 gal.), a type C certification shall be furnished in accordance with 916.

909.08 Blank.

909.09 Epoxy Penetrating Sealers.

(a) Polysulfide Type. The material shall be a system composed of a mixture of equal parts by volume of components A and B. Component A shall be a solution of totally reactive epoxy resin, which may be cut back with a reactive diluent, such as cresyl glycidyl ether. Component B shall be a solution of the specified liquid polysulfide polymer and an amine curing agent compatible with the epoxy resin. The use of butyl glycidyl ether in either component shall be prohibited.

Neither component shall contain a residual constituent which is unreactive with the epoxy resin. An amount of liquid polysulfide polymer sufficient to comply with the mercaptan

content, total sulfur, and total sulfur/mercaptan ratio requirements given below shall be contained within the component B.

660 Mineral fillers, non-volatile, or non-reactive extenders shall not be permitted in either component. Each component shall have a usable shelf life of at least six months from the date of delivery.

The epoxy resin shall be manufactured from epichlorohydrin and bisphenol A, shall contain no more than trace amounts of hydrolyzable chlorine, and may contain sufficient reactive diluent, such as cresyl glycidyl ether, to conform to the specific requirements of 909.09(c).

670 **(b) Unmodified Type.** The material shall be a system composed of a mixture of equal parts by volume of components A and B. Component A shall be a solution of a totally reactive epoxy resin, and component B shall be a solution of an amine curing agent compatible with the epoxy resin. The use of butyl glydicyl ether in either component shall be prohibited.

Neither component shall contain a residual constituent which is unreactive with the epoxy resin. Mineral fillers or non-volatile extenders shall not be permitted in either component. Each component shall have a usable shelf life of at least six months from the date of delivery.

680 The epoxy resin shall be manufactured from epichlorohydrin and bisphenol A, shall contain no more than trace amounts of hydrolyzable chlorine, shall contain no reactive diluents, and shall be in accordance with 909.09(c).

(c) Specific Requirements. Specific requirements for each type of sealer shall be as shown in the table.

Property	Polysulfide Type	Unmodified Type	Test Method
RESIN			
Epoxide Equivalent	180-195	180-195	ASTM D 1652
Viscosity @ 25EC, (77EF) Poises	5-7	100-180	ASTM D 2393
Color (Gardner) Max.	5	5	ASTM D 1544
COMPONENT A			
Viscosity @ 25EC, (77EF) cps, Max.	40	40	ASTM D 2393
Mass (Weight) per Epoxy Equivalent	180-195	180-195	ASTM D 1652 Corrected to 100% Solids Basis
Color	Clear Amber	Clear Amber	Visual
Infra Red Spectrum	Shall Essentially Match Std. Spectrum	Shall Essentially Match Std. Spectrum	AASHTO T 237
COMPONENT B			
Viscosity @ 25EC, (77EF) cps, Max.	40	40	ASTM D 2393
Color	Clear Amber	Clear Amber	Visual
Infra Red Spectrum	Shall Essentially Match Std. Spectrum	Shall Essentially Match Std. Spectrum	AASHTO T 237
Total Sulfur, % Min. Corrected to 100% Solid Basis	11.0		ASTM E 443, or other Approved Method
Mercaptan, % Min.	1.8		ITM 602
Ratio of Total Sulfur % to Mercaptan %	6.2-8.0		

1/1 VOLUME MIXTURE OF A AND B			
Viscosity @ 25EC, (77EF) cps, Max.	40	40	ASTM D 2393
Total Solid, %, Min.	50	50	ASTM D 1644 (Note 1)
Ash %, Max.	0.5	0.5	ASTM D 482
Flexibility	No Breaking or Cracking of film	No Breaking or Cracking of Film	ITM 604
Moisture Perme- ability, %, Max.	0.8	0.8	ITM 605
Color	Clear Amber	Clear Amber	Visual (Note 2)
Set to Touch, Hrs. Max.	4 (Note 3)	4 (Note 3)	FED. Test Method Std. 141 (Note 4)

(Note 1) Method A, except sample size shall be 3.0 grams ∇ 0.1 gram.

(Note 2) Poured on glass plate, and cured 48 hours @ 21EC to 27EC (70EF to 80EF).

(Note 3) Applied to tin-coated steel panel, approximately 20 ga., previously warmed to 32EC ∇ 1EC (90EF ∇ 2EF).

(Note 4) Method 4061.1, applied at mixture temperature of 32EC ∇ 1EC (90EF ∇ 2EF).

690

The polysulfide polymer used in formulation of polysulfide sealer shall be a difunctional mercaptan made from 98 mole percent of bis, 2-chlorethyl, formal and two mole percent of trichloropropane, and shall be in accordance with the following requirements:

Property	Requirements	Test Method
Specific Gravity @ 20/20EC	1.24-1.30	ASTM D 1963
Viscosity at 25EC, Poises	7-12	ASTM D 2393
PH, Water Extract	6.0-8.0	AASHTO T 200
Moisture Content, %	0.1 Max.	Fed Test Method Std. 141A Method 4082
Pour Point CE	-26.8 Max.	ASTM D 97
Molecular Mass Av.	1000 Max.	Empirical Formula
Flash Point, (Cleveland) CE	200 Min.	AASHTO T 48
Sulfur, %	36-40	ASTM D 1552
Color, Hellige	9-12	Fed Test Method Std. 141A Method 4242

(d) Low Temperature Epoxy Penetrating Sealer. A low temperature epoxy penetrating sealer shall consist of a system composed of a mixture of equal parts by volume of a totally reactive epoxy resin solution, and a solution of an amine curing agent. The epoxy

700 materials shall be in accordance with 909.09(a) or 909.09(b). The material, when mixed in accordance with the manufacturer's recommendations, shall be capable of complete curing when applied to a concrete surface at a temperature of 2EC (35EF) or above, and with an ambient air temperature of 2EC (35EF) or above. The material shall be in accordance with 909.09(c), except the set-to-touch shall be determined at -7E ∇ 1EC (20E ∇ 2EF) when applied to a tin coated steel panel at a mixture temperature of 25E ∇ 1EC (77E ∇ 2EF).

(e) **Packaging and Marking.** Each component shall be packaged in clean, steel containers. Containers for component B shall be lined with a material inert to chemical reaction with the contents.

710

Each container shall be clearly marked with the product's identification, component designation (A or B), manufacturer's name, date of manufacture, formulation number, batch number, mixing directions, and such warning information as may be appropriate or required by law. A batch shall consist of a single charge of all ingredients in a mixing vessel and is not to be confused with the formulation number.

(f) **Approval of Formulation.** Prior to furnishing any material, the manufacturer shall submit the following to the Division of Materials and Tests:

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1. A 2.0 L (1/2 gal.) sample of each separate component shall be submitted. Each sample container shall be marked with component designation, A or B, manufacturer, and manufacturer's formulation number.

2. A type A certification in accordance with 916 shall be submitted to cover the epoxy resin, the polysulfide polymer, component A, component B and the mixture of the two components. The certification shall contain the same identifying information as set out above for each container.

730

3. For an initial formulation submission, the manufacturer shall furnish an infra-red curve for each separate component. Each infra-red curve shall have the same identifying information as set out above for each container.

4. A current Materials Safety Data Sheet for each component and for the mixture shall be provided with the initial formulation submitted.

Formulation approval shall remain valid for five years from date of such approval unless Department testing of a production batch indicates a failure, or if no material has been received from the approved manufacturer for three consecutive years within the five year interval. Approval of the formulation in accordance with requirements 1 and 2 of 909.09(e) shall again be required for either situation. Changed or revised formulations shall be subjected to all of the approval requirements set out above. Submission for formulation approval shall be limited to three attempts at least 90 days apart.

740

909.10 Proprietary Portland Cement Concrete Sealers. An approved List of Proprietary Portland Cement Concrete Sealers will be maintained by the Department. The list will specify the manufacturer, sealer designation, concrete curing prior to sealer application, sealer application rate, method of sealer application, and any additional requirements for

specific sealers. The proprietary portland cement concrete sealers shall be delivered to the jobsite in unopened containers with the manufacturer's numbered seal intact.

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Sealer manufacturers wishing to have a sealer added to the Approved List of Proprietary Portland Cement Concrete Sealers shall submit to the Division of Materials and Tests a certification of compliance of their product with the requirements of NCHRP 244, Series IV, Southern climate weathering test. The certification shall be in accordance with the applicable requirements of 916, indicate the generic type of sealer, state the minimum amount of active ingredients, and include a dated report with results for the referenced tests conducted by a recognized laboratory. A recognized laboratory is a state highway agency testing laboratory, or any testing laboratory regularly inspected by the Cement and Concrete Reference Laboratory of the National Institute of Standards and Technology. Proof of such inspection shall be furnished with the test report.

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The minimum acceptable amount of active ingredients shall be 20 percent for silane based sealers and 15 percent for all other types, such as siloxane based, etc.

A current Material Safety Data Sheet shall be submitted with the certification.

Upon acceptance, the sealer will be added to the List of Approved Proprietary Portland Cement Concrete Sealers.

770

A sealer which does not perform well in the field or does not comply as expected with field testing will be removed from the Approved List.

909.11 Epoxy-Resin-Base System for Bonding Plastic Concrete to Hardened Concrete. Two-component, epoxy-resin bonding systems for use in bonding freshly mixed concrete to hardened concrete shall be in accordance with ASTM C 881 for type II, grade 2, and the class consistent with the ambient temperature as follows: class A for use below 4EC (40EF); class B for use between 4EC (40EF) and 16EC (60EF); and class C for use above 15.5EC (60EF). Material furnished under this specification shall be covered by a type C certification in accordance with 916.

SECTION 905 -- MASONRY UNITS

905.01 Clay or Shale Brick

- (a) Sewer Brick
- (b) Manhole Brick
- (c) Building Brick

905.02 Concrete Brick

905.03 Concrete Masonry Blocks

SECTION 906 -- JOINT MATERIALS

906.01 Joint Fillers

10 906.02 Joint Sealing Materials

(a) Joint Sealers

- 1. **Silicone Joint Sealants**
 - a. Physical Requirements
 - b. Field Evaluation
 - c. Specific Requirements for Installation of Silicone Joint Sealant
 - d. Certification
- 2. **Hot Poured Joint Sealant**
 - a. General Requirements
 - b. Packaging and Marking

20	<ul style="list-style-type: none"> c. Requirements for Installation d. Sampling and Testing
	3. Preformed Elastomeric Joint Seals
	(b) Backer Rod
	<ul style="list-style-type: none"> 1. Requirements 2. Certification
	906.03 Joint Mortar
	906.04 Rubber Type Gaskets
	906.05 Bituminous Mastic Pipe Joint Sealer
30	<ul style="list-style-type: none"> (a) General Requirements (b) Detail Requirements (c) Certification
	906.06 Bridge Expansion Joints
	<ul style="list-style-type: none"> (a) Type SS (b) Type BS2, BS6, BS8, BS9, BS11, and 1-A (c) Type M
	SECTION 907 -- CONCRETE, CLAY, AND PLASTIC DRAINAGE COMPONENTS
	907.01 Non-Reinforced Concrete Pipe
	907.02 Reinforced Concrete Pipe
	907.03 Reinforced Concrete Horizontal Elliptical Pipe
40	907.04 Precast Concrete Manholes, Inlets, and Catch Basins
	907.05 Precast Reinforced Concrete Box Sections
	907.06 Blank
	907.07 Blank
	907.08 Clay Pipe
	907.09 Perforated Clay Pipe
	907.10 Blank
	907.11 Drain Tile
	907.12 Blank
	907.13 Blank
50	907.14 Blank
	907.15 Blank
	907.16 Plastic Pipe Manufacturer Requirements
	907.17 Corrugated Polyethylene Drainage Tubing
	907.18 Perforated Polyvinyl Chloride Semicircular Pipe
	907.19 Corrugated Polyethylene Pipe
	907.20 Ribbed Polyethylene Pipe
	907.21 Smooth Wall Polyethylene Pipe
	907.22 Profile Wall Polyvinyl Chloride Pipe
	907.23 Smooth Wall Polyvinyl Chloride Pipe
60	907.24 Smooth Wall Pipe for Outlets
	<ul style="list-style-type: none"> (a) Type PSM Polyvinyl Chloride Pipe and Fittings (b) Schedule 40 Polyvinyl Chloride Pipe
	907.25 Solvent Cements for Polyvinyl Chloride Pipe and Pipe Fittings
	907.26 Elastomeric Seals
	SECTION 908 -- METAL PIPE
	908.01 Blank
	908.02 Corrugated Steel Pipe and Pipe-Arches
	908.03 Blank
	908.04 Corrugated Aluminum Alloy Pipe and Pipe-Arches
70	908.05 Blank
	908.06 Metal End Sections
	908.07 Fiber Bonded Fully Bituminous Coated Corrugated Steel Culvert Pipe and Pipe-Arches
	908.08 Polymer Precoated Galvanized Corrugated Steel Culvert Pipe and Pipe-Arches
	908.09 Structural Plate Pipe, Pipe-Arches, and Arches
	<ul style="list-style-type: none"> (a) Steel (b) Aluminum Alloy

	908.10 Cast Iron Soil Pipe
	908.11 Steel Pipe
	908.12 Straps, Hook Bolts and Nuts Used in Anchors
80	908.13 Fully Bituminous Coated and Lined Corrugated Steel Pipe and Pipe-Arches.
	908.14 Slotted Drain or Slotted Vane Drain Pipe
	SECTION 909 -- PAINT AND LIQUID EPOXY
	909.01 General Requirements
	909.02 For Metal
	(a) Zinc Primers
	1. Two Component and Multi-Component Inorganic Zinc Silicate Primer
	2. Single Package Inorganic Zinc Silicate Primer
	3. Organic Zinc Primer
90	4. Approval of Formulation
	5. Reapproval of Formulation
	(b) Vinyl Finish Paint
	1. Vehicle Component
	2. Pigment Component
	3. Mixed Paint Properties
	4. Color
	5. Storage Life
	6. Application
	(c) Waterborne Finish Paint
100	1. Vehicle Component
	2. Pigment Component
	3. Mixed Paint Properties
	4. Approval of Formulation
	909.03 Encapsulation Bridge Paint System
	909.04 For Wood or Metal
	(a) Primer for Field Paint
	(b) White Field Paint, Finish Coat
	909.05 White and Yellow Traffic Paint
	(a) Standard Traffic Paint
110	1. General Requirements
	2. Specific Requirements
	(b) Fast Dry Traffic Paint
	1. General Requirements
	2. Specific Requirements
	(c) White and Yellow Waterborne Traffic Paint
	1. Composition Requirements
	2. Specific Requirements
	3. Formulation Approval
	4. Formulation Reapproval
	909.06 Blank
120	909.07 Miscellaneous Paints and Ingredients
	(a) Stencil Paint
	(b) Zinc Chromate Paint
	909.08 Blank
	909.09 Epoxy Penetrating Sealers
	(a) Polysulfide Type
	(b) Unmodified Type
	(c) Specific Requirements
	(d) Low Temperature Epoxy Penetrating Sealer
	(e) Packaging and Marking
130	(f) Approval of Formulation
	909.10 Proprietary Portland Cement Concrete Sealers
	909.11 Epoxy-Resin-Base System for Bonding Plastic Concrete to Hardened Concrete